

DEVELOPMENT OF MULTIDISCIPLINARY WORKSHOPS BETWEEN DIFFERENT SUBJECTS AS AN INNOVATIVE TEACHING METHODOLOGY FOR THE ACQUISITION OF PROFESSIONAL SKILLS OF THE FUTURE ARCHITECT

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Abstract

The implantation of the new Architecture Degree and the important normative changes in the building sector imply the need to use new teaching methodologies that enhance skills and competences in order to response to the increasing requirements demanded by society to the future architect.

Our proposal is a practical application of the requirements from the new Architecture Degree to the teaching of existing subjects. The teaching methodology is based on continuous evaluation. We stimulate group work with weekly goals and also interactive classes versus traditional lectures.

We have developed workshops between different subjects, dissolving the traditional boundaries. This multidisciplinary workshop methodology allows the use of all the global knowledge acquired by students during their previous studies. It also increases their capacity of self-criticism, and it foments their ability to undertake learning strategies and research in an autonomous way. In workshops students explain their solutions in public and undertake independent research strategies.

In the previous courses, pupils have shown their majority preference for this teaching methodology.

In conclusion, this experience verifies the viability of using new teaching methodologies adapted to the new Architecture Degree with great acceptance for students and positive educational contrasted outcomes.

Keywords - Construction, workshop, multidisciplinary, innovative methodology.

1 INTRODUCTION

Background:

- The implantation of new degrees adapted to the EEES is a major overhaul of the current Syllabus of Architecture. An analysis of the experience of recent years involves an opportunity to redefine teaching methodologies in order to be adapted to the new structure of ECTS credits proposed by the European Higher Education Area (EEES).

- The last few years in the building sector have been characterized by major changes to a new regulatory framework, especially since the entry into force of the new Código Técnico de la Edificación (Technical Building Code) and the Real Decreto de Eficiencia Energética (Royal Decree of Energy Efficiency), leading to a significant increase in the demand of project's documentation and supervising construction work, all of them of great significance in architecture practice.

These new technical regulations are a good reflection of the increasing user and society requirements, which demand better performing buildings and higher construction quality.

- The new normative context is related to the necessary reorganization of the construction sector in Spain, due to the economic crisis and the non-viability of the strong housing production experienced in recent years. All this problems make clear the need to adapt the architecture profession.

As it is being analyzed from the Consejo Superior de Colegios de Arquitectos de España (Superior Council of the Professional Associations of Architects of Spain), and as it has been reflected in the recent National Congress of Architects held last July in Valencia, present and immediate future of the sector will be characterized by the necessary adjustment of the architectural profession to the new economic and socio-professional Architecture context, where specialization and research of new professional fields constitute the best response to a specialized production system more sustainable, away from the construction excess experienced in the last decade.

- The main aspects that will characterize European architect's practice in the coming years and that university education should give a response are based in specialization, better understanding and control of technical advances in the field of construction, participation in multidisciplinary teams and increasing competitiveness by opening free markets as a result of European convergence.

Problem approach:

- Given the important and recent regulatory change in the building industry is necessary to develop education to a new professional practice. It is necessary to enhance the student's ability to implement technical knowledge to solve problems in constructive and architectural projects, but also it is necessary to respond to growing social benefits and technical requirements through the application of technical and construction standards, especially the new Technical Building Code (CTE). In this new context, it is important to work on technological needs of the construction sector in Spain, promoting the study of new materials and industrial building systems in a compatible way with the knowledge, control and critical analysis of materials and traditional construction systems.

- The progressive acceleration of technical progress and quality requirements in construction increases the need for a new way of teaching. The aim is to acquire skills to undertake strategies and processes that encourage self-learning and personal research in new construction technologies, systems and materials.

Not so much the transmission of technical knowledge regarding the development of appropriate learning methodologies to enable professional training as the only possible answer for the correct adaptation to the constant and increasing regulatory change in construction and the continuing evolution of the technology used in architecture.

- The necessary adaptation of the architectural profession to the socio-economic changes requires learning methodologies which better prepare our students for future professional work in multidisciplinary teams. That's why it's especially important the ability to expose and to reason ideas and technical solutions to professional people and other heterogeneous agents involved in the construction industry. Therefore, the training process should emphasize skill acquisition regarding the transmission of ideas and reasoning ability and self-criticism of the student.

Experimental design:

- We propose the practical application of jurisdiction under the Title Memory of the future Architecture Degree of the University of Alicante to the content and teaching methodology in the current subjects of the degree, overlapping real experiences with constructive problems solving in the development of architectural design.

- The teaching methodology developed is based on the synthesis of the skills previously acquired by students, especially those related to industrialized building systems, in order to enhance their competences for practical application to practice as an architect.

- We propose both interactive classes and practical exercises supervised by teachers, working individually, in groups and in workshops. The methodology enhances the ability for understanding new concepts, the ability for working in groups, and students' ability for conveying their ideas and solutions in public exhibitions. Pupils defend their technical proposed resolutions, and it shows their capacity for self-criticism in the resolution of technical problems.

Significance of the study:

- The aim of the communication is to present, analyze and discuss the teaching methodologies employed in the subjects of Construction of Architecture Degree, designed with the objective to synthesize and complement the skills acquired by students during their studies at the same time that they enhance the skills and competences to the practical exercise of the profession, giving a response to the technical requirements and benefits that society demands of architecture and of architects.

2 DEVELOPMENT OF THE PAPER

2.1 Methods: methodological description

- Given the experimental nature of the new teaching methodology proposed, it offers to students the opportunity to voluntarily participate in the new system of continuous assessment or present themselves to the Official Exams set in June, July and December, if they want.

- As already noted, the methodology is based on continuous assessment by encouraging student participative attitude by two main types of activities:

-The interactive lecture versus traditional lecture.

-Group work through supervised practical exercises in class time.

This teaching method aims to achieve a progressive acquisition of skills through the practical application of knowledge learned in the theoretical issues. It's specially valued the positive development of students throughout the course, and also the student participation.

- The general structure of theoretical and practical course is organized around some basic educational UNITS (four in total) (Fig.1), which classify knowledge and skills to develop the fundamental concepts that we consider most important to teach (in this case: industrialized building construction).

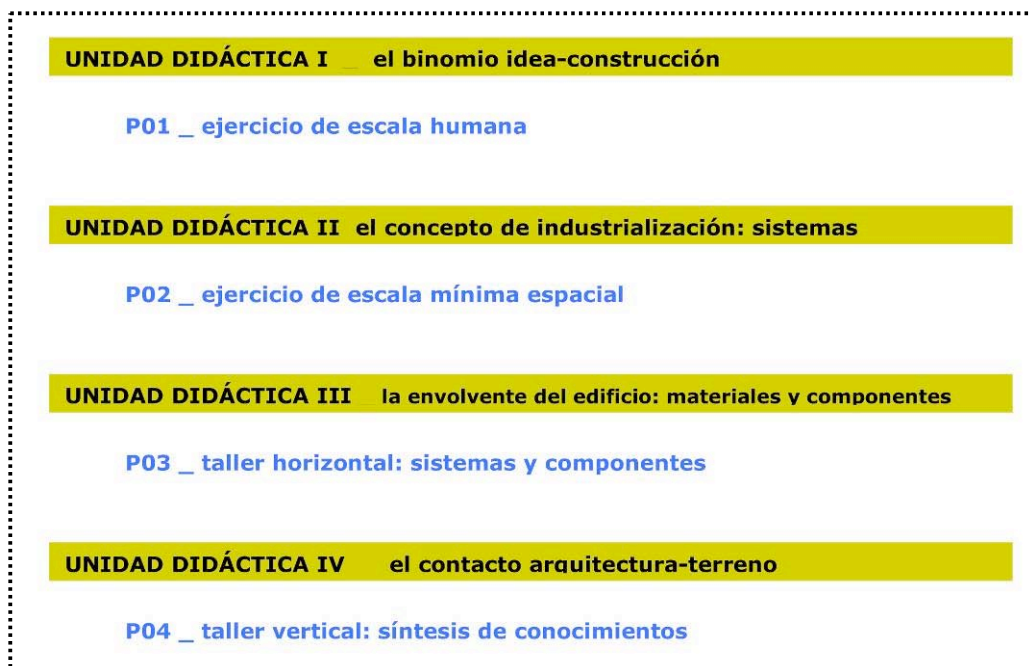


Fig 1. Didactic Units.

These blocks cover gradually and progressively the different stages of real professional work of the architect, starting from the very conception of architecture material (Fig.2), to aspects that relate the idea and construction (Fig.3), up to the final realization of architectural design (Fig. 4 and 5).

UNIDAD DIDÁCTICA I el binomio idea-construcción

- T00 _ presentación
- T01 _ el detalle constructivo
- T02 _ el proyecto arquitectónico: básico y de ejecución
- T03 _ normativa: CTE, marcado CE, eurocódigos

P01 _ ejercicio de escala humana



Fig 2. Human scale exercise.

UNIDAD DIDÁCTICA II el concepto de industrialización: sistemas

- T04 _ industrialización, prefabricación, sistemas constructivos ligeros, "en seco"
- T05 _ estructura metálica: funcionamiento, perfilaría, tornillería, soldaduras
- T06 _ estructura de madera: conceptos, uniones
- T07 _ la fachada del edificio: el concepto de "capas"
- T08 _ sistemas de envolvente ligera I: la fachada ventilada
- T09 _ sistemas de envolvente ligera II: muro-cortina
- T10 _ sistemas de envolvente ligera III: las juntas

P02 _ ejercicio de escala mínima espacial

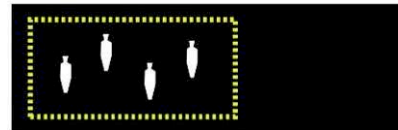


Fig 3. Minimum scale space exercise.

UNIDAD DIDÁCTICA III la envolvente del edificio: materiales y componentes

- T11 _ paneles ligeros I: grc, madera-cemento, resinas
- T12 _ paneles ligeros II: metálicos
- T13 _ paneles ligeros III: poliméricos
- T14 _ textiles: características, tensores
- T15 _ vidrio: naturaleza, tipos, criterios de selección
- T16 _ piedra: materiales, sistemas (prof. Roberto Vera)
- T17 _ piezas individuales: ladrillos, bloques de hormigón
- T18 _ paneles pesados: hormigón (prof. Servando Chinchón)

P03 _ taller horizontal: sistemas y componentes

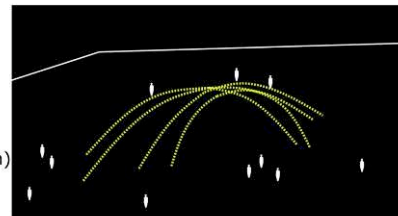


Fig 4. Horizontal Workshop: systems and components

UNIDAD DIDÁCTICA IV el contacto arquitectura-terreno

- T19 _ geotecnia (prof. Servando Chinchón)
- T20 _ drenajes (prof. Servando Chinchón)
- T21 _ pavimentos continuos
- T22 _ pavimentos discontinuos

P04 _ taller vertical: síntesis de conocimientos

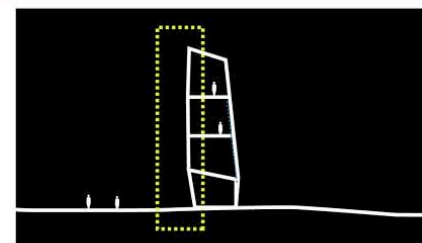


Fig 5. Vertical Workshop: synthesis of knowledge.

Under this storyline, all theoretical and practical content of the subject is vertebrated into teaching units and it is composed by a series of theoretical concepts that develop the fundamental matter of the teaching unit and that it's complemented by practical exercises used in parallel to work in groups.

- The teaching methodology raises the following issues:

- Participatory presence in the classroom and the students' work in teams on practical exercises.
- The adequacy of the work in progress satisfying weekly goals.
- The individual chargeability and positive interdependence of students. It's valued participatory attitude in the working group, evaluation of their knowledge and domain of all the solutions developed by his team, responding to questions raised about the exercise.
- The student's ability to convey their ideas and solutions in public, knowing how to argue and defend his proposed technical resolutions to peers and teachers. For public exhibitions is proposed (Fig. 6) that students review and assess the work of other colleagues (Peer Reviewing) (Fig. 7) while stimulating their own self-assessment.

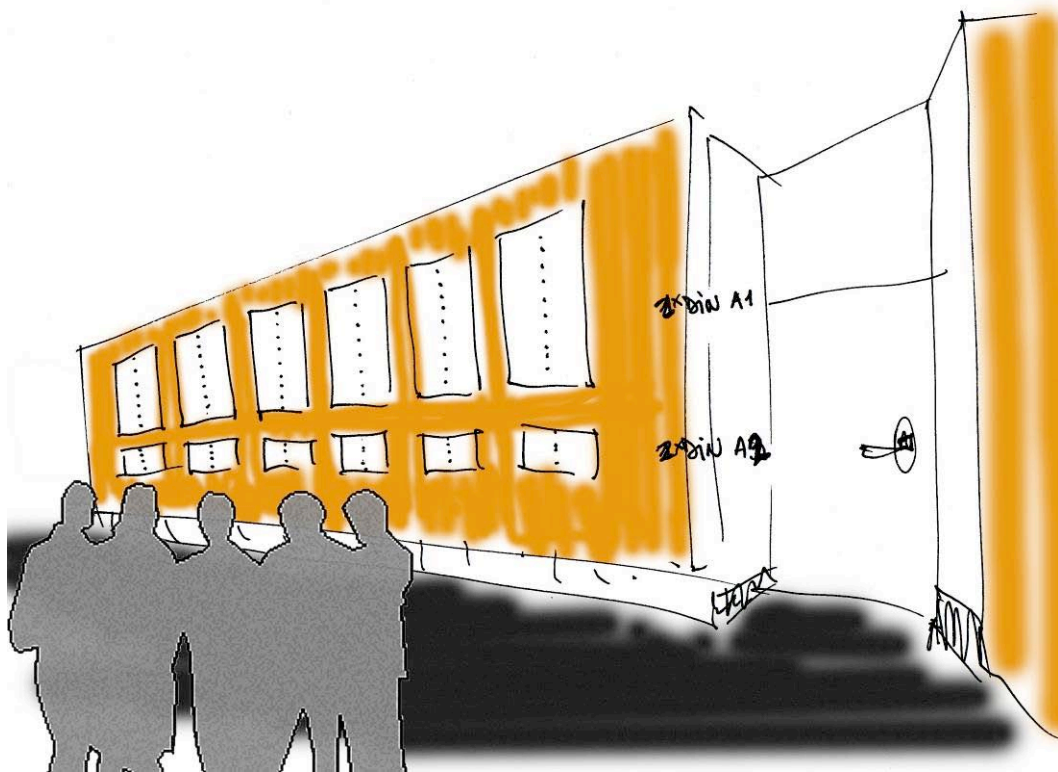


Fig 6. Public Exhibition.

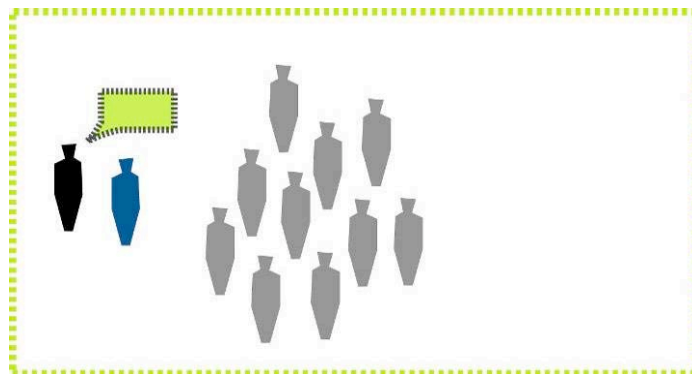


Fig 7. Peer reviewing.

- Sharing knowledge and skills among students of different levels of the degree through interaction and public discussion on "vertical workshops" (Fig. 8) between courses of Construction, and "horizontal workshops" (Fig. 9) between subjects of different knowledge areas within the "Block Technology" of the future title of Architecture Degree (subjects of Construction, Structures and Installations).

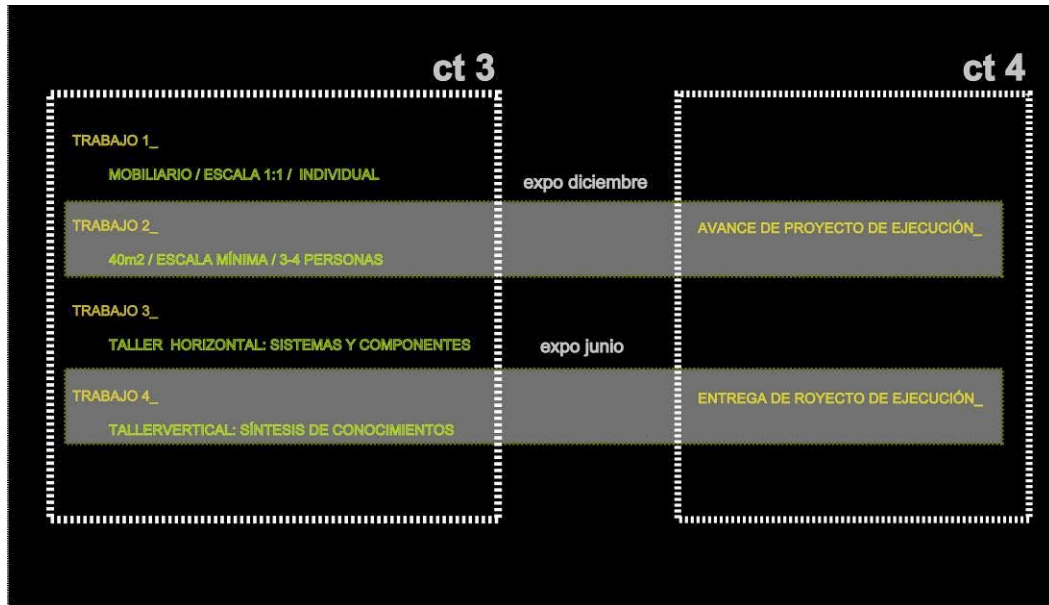


Fig 8. Vertical Workshop

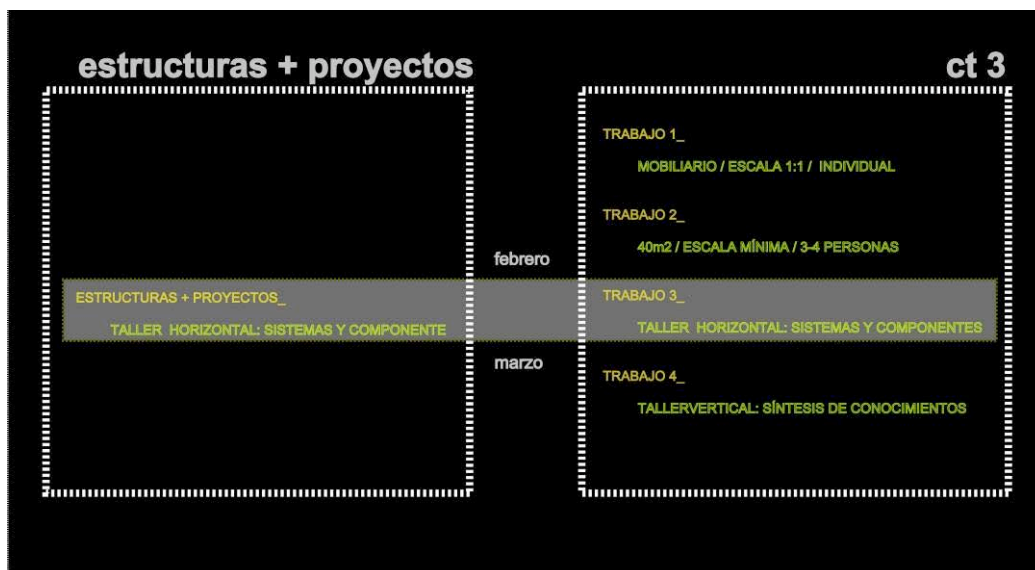


Fig 9. Horizontal Workshop

-Evaluation criteria are based on the assessment of both knowledge and skills displayed by the student for the proper performance of his professional practice as an architect. These aspects show their concern and capacity of research development on new materials and construction technologies involving technical innovations that enhance construction quality (Fig.10, 11 and 12).

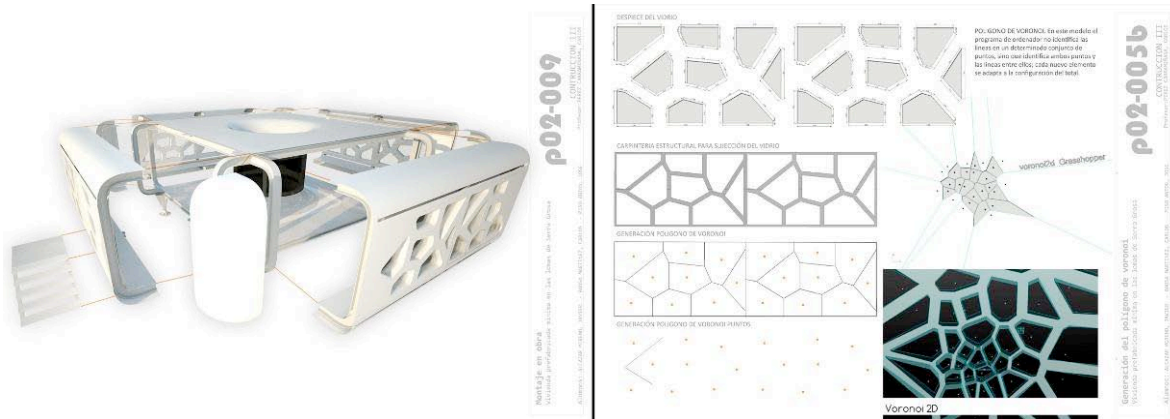


Fig 10. Coursework 2009-2010.

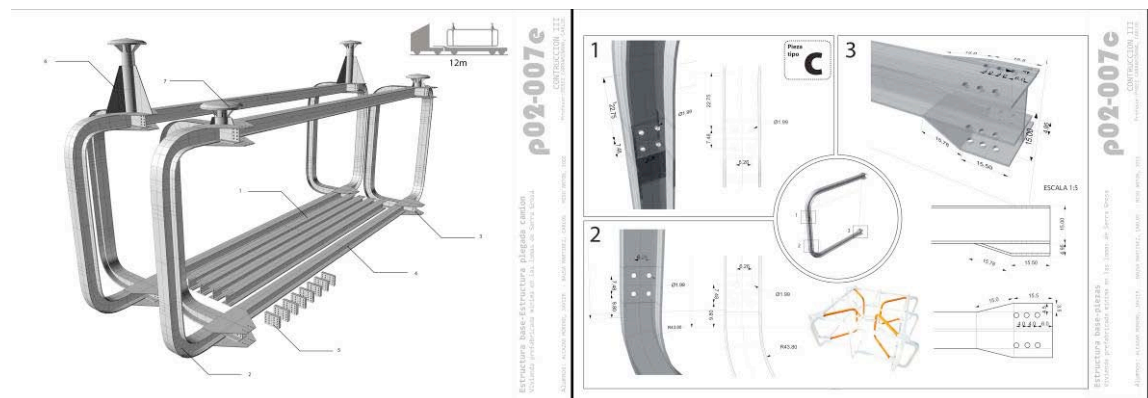


Fig 11. Coursework 2009-2010.

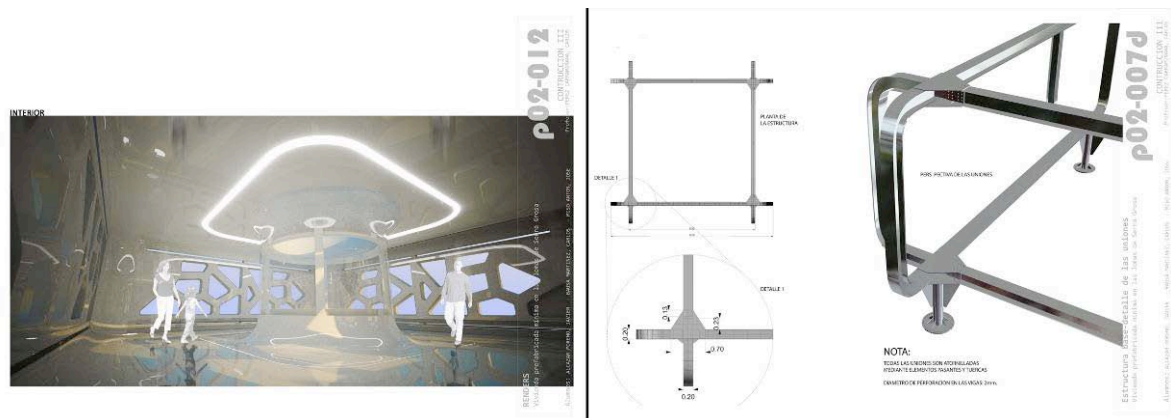


Fig 12. Coursework 2009-2010.

Therefore, taking into account the correct and full completion of the documentation required for technical Architecture projects, as well as the proper expression of their content, criteria and technical arguments about the relationship between architectural idea and its construction are set for evaluating the adequacy of resolution constructive proposal for the structure, envelope, compartmentalization, finishes and building facilities.

2.2 Results

- The implementation of new teaching methodologies employed in the subjects of Construction of Architecture degree evidences the preference of students for learning through continuous assessment against traditional exams. The voluntary choice by the students of new experimental methodologies instead of conducting the Official Exams set has been massive, with over the 90% of pupils decanted by the system of continuous assessment and workshops.

- Attendance and active student participation in theoretical-practical classes is very satisfactory. Students choose the proposed methodology despite being free to choose an apprenticeship with free assistance and qualification by examinations.

- The academic results obtained in the subjects where teachers have implemented the methodologies described are very satisfactory, both in absolute and comparative terms with other core and compulsory subjects of the degree.

2.3 Discussion

- The setting of weekly goals on practical work throughout the course enhances the students' participatory presence at all classes and the continued work (Fig. 13), ensuring the development of the exercises continuously in time, delivery of the work on schedule and achieving the quality of the objectives proposed.

PLANNING DOCENCIA									
CURSO 2009/2010 ARQUITECTURA									
CONSTRUCCIÓN 3									
	LUNES	MARTES	MIERCOLES	JUEVES	VIERNES	SABADO	DOMINGO		
SEPTIEMBRE	1		2	3	4	5	6		
7	8		9	10	11	12	13		
14	15	16	17	18	19	20	21		
22	23	24	25	26	27	28	29		
OCTUBRE	30	1	2	3	4	5	6		
7	8	9	10	11	12	13	14		
15	16	17	18	19	20	21	22		
23	24	25	26	27	28	29	30		
NOVIEMBRE	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		
DICIEMBRE	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		
ENERO	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		
FEBRERO	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		
MARZO	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		
ABRIL	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		
MAYO	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		
JUNIO	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		
JULIO	1	2	3	4	5	6	7		
8	9	10	11	12	13	14	15		
16	17	18	19	20	21	22	23		
24	25	26	27	28	29	30	31		

Fig 13. Workshop Planning and student tab

- The exhibitions and public corrections of the work stimulate the enforceability of each individual student while develops the ability to work in multidisciplinary teams and distribution of tasks, resulting an interdependence among group members. They develop also the capacity for coordinate their

solutions to be able to be questioned and evaluated on any of the technical aspects of the work done together. The review and valuation of work between different partners (Peer Reviewing) (Fig.14) stimulates the ability of self-evaluation of personal work.



Fig 14. Peer reviewing.

- Combined corrections and workshops between students of different subjects (vertical workshops) (Fig.15 and 16) promote the sharing of knowledge and skills among students of different levels of training effort by stimulating public discussion and interaction between students, generating a straight line and additional training.



Fig 15. Vertical Workshop.



Fig 16. Vertical Workshop.

- Practical exercises (Fig.17) enhance the training of future architect and offer a better response to the new features of professional practice set out in the introduction.

TRABAJOS de CURSO
CURSO 2009/2010_ARQUITECTURA

CONSTRUCCIÓN 3

p01 ejercicio de escala humana

enunciado
puesto para venta ambulante

ubicación
zona turística de la ciudad de Alicante

condicionantes
- superficie entre 5 y 10 m²
- sistemas constructivos industrializados
- se podrá transportar en una furgoneta (una vez desmontado)
- cumplirá con la normativa vigente

criterios de diseño
- durabilidad y bajo mantenimiento
- fácil montaje y desmontaje
- posibilidad de agrupar varios módulos
- prestaciones según ambiente exterior
- posibilidad de suministro de energía eléctrica
- prestaciones antivandálicas

criterios de valoración
se valorará especialmente:
- relación idea - construcción
- manejo de escalas conceptuales
- expresión del contenido:
+ facilidad de lectura de los planos
+ sistema de acotado
+ exhaustividad en la leyenda
+ maquetación de la información en los planos

objetivos semanales
los apartados del trabajo a desarrollar y corregir en clase cada semana serán:
- 29 septiembre: relación idea-construcción
- 6 octubre: sistema estructural, envoltorio y capas del cerramiento

desarrollo y fechas de entrega
- trabajo individual
- formato: planos en din a-3 + CD en PDF
- entrega: entrega oficial: 13 octubre 2009
fecha máxima: 19 octubre 2009

no se admitirán trabajos:
- entregados posteriormente a la fecha máxima
- con documentación incompleta

contenido de la entrega
- memorias: descriptiva y justificativa
- memoria técnica de materiales
- esquema de funcionamiento estructural
- esquema de capas del cerramiento: (prestaciones, función, dimensiones, materiales)
- planos:
+ emplazamiento seleccionado
+ plantas, alzados y secciones acotados (1:20)
+ planos de detalle (1:1, 1:2, 1:5 y/o 1:10)
- referentes arquitectónicos utilizados

TRABAJO 1 el binomio idea - construcción

TRABAJOS de CURSO
CURSO 2009/2010_ARQUITECTURA

CONSTRUCCIÓN 3

p02 ejercicio de escala mínima espacial

enunciado
vivienda prefabricada mínima

ubicación
terreno inclinado con pendiente de 15 grados

condicionantes
- superficie entre 40 y 60 m²
- sistemas constructivos industrializados
- montable y desmontable:
se podrá transportar en camiones, subdividida en el menor número de partes posible
- cumplirá con la normativa vigente

materiales
- estructura: acero o madera
- cimentación: prefabricada de hormigón
- cerramiento exterior:
+ chapas o paneles metálicos
+ materiales plásticos
+ paneles fenólicos
- instalaciones:
+ fontanería y ACS solar térmica
+ electricidad: solar fotovoltaica

criterios de diseño
- durabilidad y bajo mantenimiento
- fácil montaje y desmontaje
- prestaciones según ambiente exterior

criterios de valoración
se valorará especialmente:
- relación idea - construcción
- manejo de escalas conceptuales
- expresión del contenido

objetivos semanales
los apartados del trabajo a desarrollar y corregir en clase cada semana serán:
- 29 octubre: análisis de referentes
conclusiones aplicables al proyecto
- 10 noviembre: relación idea-construcción y sistema estructural
- 17 noviembre: envoltorio y capas del cerramiento
compartimentación y acabados, proceso montaje
- 24 noviembre: instalaciones, detalles constr.
- 1 diciembre: documentación final, grafismo

fases de entrega
+ FASE 1: análisis 3 noviembre 2009
+ FASE 2: documentación 1 diciembre 2009
+ FASE 3: exposición 15 diciembre 2009

- trabajo en grupos (máx. 3)
- formato:
+ fase 2: planos en din a-3 + CD en PDF
+ fase 3: 2 paneles en A2
- no se admitirán trabajos:
+ entregados posteriormente a la fecha máxima
+ con documentación incompleta

contenido de la entrega
- análisis de referentes arquít. y constructivos
- memoria (adaptada al CTE)
- anexo: memoria técnica de materiales
- esquema de funcionamiento estructural
- esquema de capas del cerramiento: (prestaciones, función, dimensiones, materiales)
- esquema de instalaciones
- descripción gráfica montaje-desmontaje
- planos:
+ situación y emplazamiento seleccionado
+ plantas, alzados y secciones acotados
+ sección idea construcción 1:20
+ planos de detalle constructivo
- pliego de prescripciones técnicas particulares

TRABAJO 2 el concepto de industrialización: sistemas

Fig 17. Practical exercises 1 and 2.

- The teaching methodology experienced in the subjects of construction is also applicable to other subjects of the degree of different content. Methods and results are directly exposed to the necessary practical aspect of the architectural profession, which is extensible to other degrees, and all their subjects and specialties.

- The proposed methodologies can complement and synthesize the diversity of knowledge acquired by students at different stages of the degree. The acquired skills form a coherent thought process that balances and give meaning to the general managed data, prioritizing the proper synthesis of all dominated notions of individuality versus disconnected from knowledge acquired during the titration.

3 CONCLUSIONS

- We can conclude that the new teaching methodologies that develop and implement the new Title of Degree of Architecture allow enhancing skills that are applicable to the practical exercise of the profession. These skills allow answering the requirements of the important policy changes experienced in the building sector and the increasing technical requirements demanded by today's society and whose compliance must undertake the future architect.

- The methodologies and types of proposals enhance teaching methodologies that combine the acquisition of skills required and that are directly applicable to the future professional architect with improved learning and research strategies to develop technical innovations that enhance the quality improvement of construction in our country.

- The different types of workshop and the public exhibitions proposed reveal the importance of these exercises to provide adequate training for future professionals. Leadership skills and group work, adapted to practice in multidisciplinary teams answer the current need of a greater specialization.

- In conclusion, the research verifies now the viability and suitability of introducing new content and teaching methodologies necessary for the acquisition of skills demanded by the future Architecture Degree, with great acceptance in the student's opinion and contrasted positive educational outcomes.

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